

NON-PUBLIC?: N
ACCESSION #: 9304260188
LICENSEE EVENT REPORT (LER)

FACILITY NAME: South Texas, Unit 2 PAGE: 1 OF 05

DOCKET NUMBER: 05000499

TITLE: Reactor Trip Due to Failure of a Main Turbine Electro-Hydraulic Control Line
EVENT DATE: 01/23/93 LER #: 93-001-01 REPORT DATE: 04/21/93

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
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COMPONENT FAILURE DESCRIPTION:
CAUSE: SYSTEM: COMPONENT: MANUFACTURER:
REPORTABLE NPRDS:

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On January 23, 1993, Unit 2 was in Mode 1 at 100% power. At 2324 hours, Unit 2 automatically tripped from full power due to a turbine trip above the P-9 (50% power) setpoint as the result of a depressurization of the Electro-Hydraulic Control (EHC) supply header. The low EHC System pressure was due to a leak on the low pressure governor valve line of the Steam Generator Feedwater Pump (SGFP) #22. The failure initiated on the outside surface with no defect present. Towards the latter part of the failure, secondary fatigue initiated from the inside as well. Rapid changes in the valve position created excessive movement within the valve and low pressure line. The excessive movement was apparently the result of an exposed wire on the Linear Variable Differential Transformer (LVDT). Corrective actions include replacing the failed EHC line and the LVDT.

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END OF ABSTRACT

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DESCRIPTION OF EVENT:

On January 23, 1993, Unit 2 was in Mode 1 at 100% power. At 2324 hours, Unit 2 automatically tripped due to a turbine trip above the P-9 (50% power) setpoint. The Main Turbine tripped due to a low Electro-Hydraulic Control (EHC) pressure below the 1350 psig setpoint. The depressurization was caused by a failure on the EHC supply line to the low pressure governor valve for Steam Generator Feedwater Pump (SGFP) #22.

The section of fractured tube/fitting assembly has been analyzed. The failure of the EHC Line was due to fatigue. The striation spacing appears to indicate low cycle fatigue which occurs typically due to high alternating stresses, possibly accentuated by local stress concentration of a socket weld. The failure initiated on the outside surface with no defect present. Towards the latter part of the failure, secondary fatigue cracking initiated from inside as well. The fact that the failure initiation was not associated with a weld defect indicates that the fatigue failure was due to vibration rather than due to poor weld quality.

Following repairs on January 28, 1993, excessive motion of SGFP #22 was observed on the high pressure supply line to the low pressure governor valve and in the governor valve itself. Chart recordings revealed intermittent spiking. The Linear Variable Differential Transformer (LVDT) which provides the feedback signal to the electronic controller to confirm valve position was replaced. SGFP startup was initiated and no abnormal line vibrations or valve motions were found. Visual inspection of the replaced LVDT identified a section of bare wiring. The LVDT has been sent to the original manufacturer for failure mode analysis.

During this event, AFW pump #24 started and provided flow to the Steam Generator as required. While manually tripping the Auxiliary Feedwater (AFW) Pump #24 from the Control Room, a mechanical overspeed trip condition was indicated, however, no actual overspeed condition existed. An assessment of the AFW overspeed trip linkage revealed that when the machine was tripped electrically from the Control Room, the trip/throttle valve would go shut as designed, but the latch mechanism on the overspeed trip indication device was becoming unlatched. The unlatching occurred when the pump was electrically tripped from the Control Room.

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DESCRIPTION OF EVENT: (Con't)

Additionally, a conflict was noted between the Vendor Manual and HL&P procedures with regards to the methods used for tripping the AFW Turbine. During this event, an additional problem was identified with the Startup Feedwater Pump recirculation valve which failed to open, causing feedwater flow oscillations between 0 to 4000 gpm. The Startup Feedwater Pump was subsequently secured and the recirc valve was opened. The Startup Feedwater Pump was restarted and feedwater to the steam generators was established.

CAUSE OF EVENT:

The cause of the reactor/turbine trip was the failure of an Electro-Hydraulic Control line of the SGFP #22 causing a low EHC system pressure trip. The failure initiated on the outside surface with no defect present. Towards the latter part of the failure, secondary fatigue cracking initiated from inside as well. The fact that the failure initiation was not associated with a weld defect indicates that the fatigue failure was due to vibration rather than due to poor weld quality. It is hypothesized that an exposed wire on the LVDT caused intermittent electrical signals producing rapid changes in the low pressure governor valve position, thus, creating excessive movement within the valve and the low pressure line.

The cause of the mechanical overspeed indication of the AFW #24 pump was a misadjustment in the trip linkage which, when securing the pump electrically, caused the latch mechanism to become unlatched.

The cause of the Startup Feedwater Pump recirculation valve failure to open was valve leakage which caused the valve to become unbalanced and close, or remain closed, with upstream pressure. Valve leakage was attributed to scoring of the valve plug and body.

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ANALYSIS OF EVENT:

This event is reportable pursuant to 10CFR50.73(a)(2)(iv). There were no adverse radiological or safety consequences as a result of this event. All Engineered Safety Systems functioned as designed, with the exception of the problems that were encountered while manually tripping the AFW pump

#24 which resulted in a mechanical overspeed trip indication.

CORRECTIVE ACTIONS:

The following corrective actions have been or will be taken as the result of the reactor trip:

1. The failed EHC line was replaced.
2. The failed section of EHC line was sent offsite for failure analysis. The failure of the EHC Line was due to fatigue. The striation spacing appears to indicate low cycle fatigue which occurs typically due to high alternating stresses, possibly accentuated by local stress concentration of a socket weld. The failure initiated on the outside surface with no defect present. Towards the latter part of the failure, secondary fatigue cracking initiated from inside as well. The fact that the failure initiation was not associated with a weld defect indicates that the fatigue failure was due to vibration rather than due to poor weld quality.
3. Additional non-destructive examinations were performed on similar welds within the EHC system. No generic problems were identified.
4. The Linear Variable Differential Transformer has been replaced and the original LVDT was sent offsite for failure analysis. Conversations with the vendor indicates that no problems were identified with the LVDT. A second failure analysis will be performed using additional information provided by HL&P. If results of the second failure analysis indicate a cause of failure, HL&P will supplement this report.

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CORRECTIVE ACTIONS: (Con't)

The following corrective actions have been or will be taken as the result of the AFW pump overspeed indication:

1. Adjustments were made to the mechanical overspeed linkage clearance and the pull force on the spring.
2. HL&P has revised the applicable AFW procedures to ensure these procedures adequately address securing the AFW pump.

The following corrective action has been taken on the Startup Feedwater Pump recirculation valve:

1. The Startup Feedwater Pump recirculation valve was disassembled, inspected, cleaned and reworked. Additionally, the plug seal and plug were replaced. Upon completion of these troubleshooting activities, the valve was satisfactorily stroked.

ADDITIONAL INFORMATION:

There have been three previous events involving reactor trips associated with the Electro-Hydraulic Control System. The LERs are as follows:

- o Unit 1 LER 89-001 regarding a reactor trip due to a failure in the Electro-Hydraulic Control circuit which caused the Main Turbine throttle valve to close. The cause of this failure was a poorly crimped lug on a vendor supplied circuit card.
- o Unit 2 LER 90-005 regarding a reactor trip due to a loss of EHC fluid caused by a weld failure which was caused by governor valve induced vibration. The cause of the governor valve vibration was determined to be valve plug rotation.
- o Unit 1 LER 90-015 regarding a reactor trip due to a loss of EHC pressure caused by oscillation in the Main Turbine governor valve. Oscillations were caused by a loose connection in the control circuit.

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